IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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TITLE: SAFETY SYRINGE WITH CAP HOLDING DEVICE

SPECIFICATION

BACKGROUND OF THE INVENTION

RELATED APPLICATIONS

This application claims the priority of Provisional Patent Application Serial No. 60/452,981, filed March 7, 2003, the entire disclosure of which is expressly incorporated herein by reference.

FIELD OF THE INVENTION

The present invention relates to a device for holding a dental or medical syringe for safe and convenient capping and uncapping of the needle on the syringe.

RELATED ART

The use of needles and syringes in medical and dental applications is widespread. However, the danger of needle sticks inheres in all stages of syringe use, e.g., assembly, uncapping, injection, recapping, disassembly, and discarding. Where deadly diseases can be transmitted by inadvertent needle sticks, the desirability of preventing such inadvertent needle sticks is obvious.

This problem is of particular concern with standard dental and medical safety syringes. Because dental safety syringes are designed to be re-loaded and re-used on the same patient to

administer additional doses of anesthetic, where necessary, there is increased exposure of the user's hands to the needle during uncapping and recapping. Further, there is also a risk of exposure of needle sticks from medical syringes during un-capping, use, and re-capping, despite the fact that medical syringes are designed for a single use.

Attempts have been made to design products that provide a "safe" yet easy-to-use method of uncapping and recapping a needle on a syringe. However, many of these products, while offering some advantages, still expose the needle to the user's hands at some point in the assembly or operation, are complicated to assemble, cumbersome to use, or because they include disposable parts, produce excessive medical waste.

For example, "scooping up" the cap using the needle is a recommended method of recapping a needle. An example of a built-in recapper based on the scooping method is the disposable SCOOPCAP manufactured by JRM Enterprises, Inc. and designed for use on standard dental syringes. Although the Scoop Cap is attractive because it requires minimal assembly and produces minimal medical waste, the needle still remains in close proximity to the user's hand during assembly and disassembly, thus affording little protection to the user from needle sticks during these steps.

Another safety needle which fits standard metal syringes is the SAFE-MATE safety needle (MedPro, Inc., Lexington, KY) which has a lockable, slidable, protective sheath covering the needle. Although the slidable sheath protects the user's hand during assembly and disassembly of the needle to and from the syringe, and this safety needle produces minimal

medical waste, the sheath remains attached to the syringe during use. This disadvantageously impedes access to all areas of the mouth, limiting certain dental procedures such as maxillary posterior injections.

A fully disposable dental syringe assembly has been developed by DENTALOGIC by Protecs Medical Corporation, Miami, Florida. This syringe provides adequate protection from hazard to the user during assembly and capping because the needle is not openly exposed to the user. However, assembly time is excessive, and, although the syringe is designed to be used with one hand, handling the syringe with one hand requires undue manual dexterity. Further, the syringe is not reloadable, which is a disadvantage if another dose of medication is required. Because the syringe is not reloadable, and is totally disposable, excessive medical waste ensues.

Another fully disposable dental syringe assembly, Hypo Safety Cartridge Syringe, has been developed by Dentsply MPL Technologies, Franklin Park, IL. Although it is pre-assembled, and provides some protection from sticks from the needle when it is attached to the syringe, this syringe assembly still leaves the injection end of the needle exposed during needle uncapping and capping, and therefore still presents a hazard of needle sticks to the user.

Thus, there remains a need for a safe and convenient method for capping and uncapping a standard medical or dental syringe with one hand which requires minimal assembly, has no assembly or disassembly hazard, is reloadable, results in minimal medical waste, and preferably minimizes hand exposure during needle capping and uncapping.

SUMMARY OF THE INVENTION

The present invention relates to a safety syringe and cap holding device comprising a hub for supporting a needle; a cap (or cover) interconnected with the hub, the cover having one or more protrusions for engaging one or more recesses on the hub; a housing having a receptacle for receiving the cap; means in the housing for disengaging the one or more protrusions on the cap from the one or more recesses on the hub to allow the needle to be withdrawn from the cap; and means in the housing for allowing the cap to be withdrawn from the housing. Electronic control of the cap holding device can be provided, wherein the protrusions of the cap can be engaged and disengaged by one or more solenoids or other similar devices.

A method of using a syringe is provided, the method comprising providing a needle assembly including a hub, a needle, and a cover interconnected with the hub and covering the needle; engaging the needle assembly with a syringe body; inserting the needle assembly into a cover holding device; activating the cover holding device to permit the needle to be withdrawn from the cover; using the syringe; reinserting the syringe body and needle into the cover in the cover holding device; and actuating the cover holding device to remove the syringe body, needle assembly, and cover from the cover holding device. The step of activating the cap holding device to permit the syringe and needle to be withdrawn from the cap comprises actuating a switch remote from the needle and the cap holding device.

BRIEF DESCRIPTION OF THE DRAWINGS

Other important objects and features of the invention will be apparent from the following Detailed Description of the Invention taken in connection with the accompanying drawings in which:

FIG. 1 is an exploded side view of the components of a safety syringe and cap of the present invention.

FIG.2 is a side view of the safety syringe shown in **FIG. 1** in assembled form.

FIG.3 is a cross-sectional view of a portion of the safety syringe shown in **FIG. 2** inserted and locked into a cap holding device of the present invention.

FIG. 4 is a cross-sectional view of a portion of the safety syringe and cap holding device shown in **FIG. 3** with the cap unlocked from the syringe.

FIG. 5 is a cross-sectional view shown in **FIG. 4**, with the syringe withdrawn from the cap holding device.

FIG. 6 is a cross-sectional view of a portion of the safety syringe in the cap holding device with the safety syringe and cap being unlocked.

FIG. 7 is a cross-sectional view shown in **FIG. 6**, with the safety syringe and cap withdrawn from the housing.

FIG. 8 is a view showing an alternate embodiment of the cap holding device of the present invention, wherein electronic control is provided.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to a safety syringe and cap holding device. The invention comprises a hub for supporting a needle, a cap (or cover) interconnected with the hub and having one or more protrusions for engaging one or more recesses on the hub, a housing having a receptacle for receiving the cap, means in the housing for disengaging the one or more protrusions on the cap from the one or more recesses on the hub to allow the needle to be withdrawn from the cap, and means in the housing for allowing the cap to be withdrawn from the housing. Electronic control of the cap holding device can be provided, wherein the protrusions of the cap can be engaged and disengaged by one or more solenoids or other similar devices. The safety syringe can be used in any environment where protection from needle sticks is desired, such as in dental and medical environments.

A safety syringe and cap according to the present invention is shown in **FIGS. 1** and **2**. The syringe, generally indicated at **10**, includes a cylindrical hollow body **20**, a plunger assembly **30**, and a needle assembly **40**. A cap **50** is configured to cover the needle assembly **40**.

A hollow central chamber **22** in the body **20** of the syringe **10** is partially open for receiving a drug cartridge **24** therein. The plunger assembly **30** is moveable through the body **20** and the cartridge **24** to force the contents of the cartridge **24** out through the needle assembly **40**. Finger rests **26** extend out from the upper end of the body **20** for allowing a user's fingers to grasp the body **20** while the plunger **30** is actuated by the user's thumb inserted into loop **32**. The lower end of the syringe body **20** includes a threaded shaft **28** for engagement with the needle assembly **40**.

Needle assembly **40** comprises a hub **42** interconnected with a needle **44**. The needle has a cartridge end **46** and an injection end **48**. The hub **42** has threads for threadable engagement to the threaded shaft **28** of syringe body **20**. The hub includes one or more recesses **43**, which may be annular, about an exterior surface. After drug cartridge **24** is inserted into central chamber **22** of the syringe, the needle assembly **40** is attached to the syringe body. The hub **42** is threadably engaged to syringe body **20** causing the cartridge end **46** of needle **44** to pierce the septum of, and extend into, drug cartridge **24**.

The cap **50** is positioned over needle assembly **40**. The cap **50** is generally cylindrical, being defined by one or more annular walls **52**. It is closed at the bottom **54**, but is open at the top. The cap **50** is configured to extend about injection end **48** of needle **44**, about hub **42** and past the cartridge end **46** of needle **44**. The cap **50** can be made of any suitable material, such as plastic, as is generally known in the industry. By covering the injection end **48** and the cartridge end **46** of needle **44**, the cap **50** protects against inadvertent needle sticks.

The cap **50** is retained on needle assembly **40** by attachment to hub **42**. The cap **50** has one or more internally facing protrusions **56** for engaging the one or more recesses **43** on hub **42**. The recess **43** in the hub **42** could be one or more discrete recesses or an annular recess into which one or more corresponding protrusions **56** on the inner wall of the cap **50** can extend. In order to engage and disengage the cap **50** with hub **42**, as will be hereinafter described, it is desirable to permit the protrusions **56** to be movable out of engagement with the one or more recesses **43**. One way to provide for such movement is to cut away the wall of the cap **50** about

the protrusions **56** so that a tab supporting the protrusion **56** remains, the tab being movable with respect to the remainder of the cap wall.

Cap **50** further includes one or more handles **58** on the exterior wall of cap **50** corresponding to the protrusions **56**. The handles **58** are used for moving the protrusions **56** into and out of engagement with the one or more recesses **43** of hub **42**. Where the protrusions **56** are positioned on tabs, the handles **58** would be positioned on the exterior surfaces of the tabs. Extending from the bottom **54** of cap **50** is end post **60** having a recess **62**, the purpose of which will be hereinafter described.

FIG. 3 shows a portion of the syringe **10**, having the cap **50** attached thereto, inserted into a cap holding device **70**. The cap holding device **70** comprises a housing **72** having a receptacle **74** for receiving the syringe **10** and cap **50** therein. A stop projection **76** is located at the bottom of the receptacle **74**. Hooks **80** for engaging cap handles **58** are provided in the receptacle **74**. The receptacle **74** and the cap **50** have complimentary geometries to align the cap handles **58** and the hooks **80** when the syringe **10** and cap **50** is inserted into the receptacle **74**.

Hooks **80** are components of a linkage system provided within the housing **72** of cap holding device **70**. The linkage system can be actuated to move the hooks **80** away from the cap **50**, to pull the protrusions **56** to disengage the protrusions **56** from the hub **42** to disengage the cap **50** from the syringe **10**. The hooks **80** extend from pivots **82**. Arms **84** extend out from pivots **82**. Arms **84** are interconnected with vertical rods **86**, which are attached at lower ends to levers **88** which sit on fulcrums **90**. Pistons **92**, which can be actuated by a foot pedal **94** that

moves the levers **88** about fulcrums **90** to move vertical rods **86** in a downward direction, pulling down arms **84** and pivoting the hooks **80** radially outward to pull the handles **58** and corresponding protrusions **56** on cap **50** radially to disengage the cap **50** from the syringe **10**. The vertical rods **86** are naturally biased, such as by springs **87**, in an upward direction so that when the foot pedal **94** is released, the rods **86** move back up and the hooks **80** return the handles **58** and therefore the protrusions **56** to a locking position.

Hooks **80** can merely be rods which engage the handles **58**. The handle **58** could be in the form of a ring or the like, having an aperture through which hooks **80** can extend. Alternatively, the hooks could be Y-shaped and the handles could comprise a post received by the Y-shaped hook. A cap or enlargement on the end of the post would allow a Y-shaped hook to bear thereagainst to allow the hook to pull the post.

FIGS. 4 and **5** show how the needle **44** on the syringe **10** is unsheathed and re-sheathed. First, a cartridge **24** is loaded into a syringe **10**, and the capped needle assembly **40** is attached to syringe body **20**. Then the capped syringe **10** is inserted into the receptacle **74** of cap holding device **70**. In order to remove the syringe **10** from the holder **70** without the cap (so that the syringe can be used) the foot pedal **94** is actuated, as shown by arrow **A**, to activate pistons **92** to move them in an upward direction as shown by arrow **B**. Movement of pistons **92** upward moves levers **88** about fulcrums **90** to pull vertical rods **86** down in the direction of arrows **C**, against the bias of springs **87**. The downward movement of rods **86** pull arms **84** about pivots **82** to move hooks **80** out in the direction indicated by arrows **D**. Such movement pulls handles **58** to unseat protrusions **56** from the one or more recesses **43** in hub **42**. The syringe **10** can then be

withdrawn from the housing **72** by moving it in the direction of arrow **E**, while the cap **50** remains in the housing. The foot pedal **94** can then be released, and the linkage system returns to a locking position.

After the syringe is used, e.g., after injection of the drug into the patient, the syringe is re-inserted into the cap **50** in the housing. The protrusions **56** on the cap engage the one or more recesses **43** on the hub **42**. The hub **42** may have a sloped edge leading to the protrusions **56** to cam them back into the one or more recesses **43**. In this manner, the syringe can be unsheathed, used, and then re-sheathed in a safe and convenient manner minimizing exposure of a user's hands to the needle.

FIGS. 6 and **7** show the mechanism for engaging and disengaging the cap **50** in the cap holding device **70**. When the syringe **10** is inserted into the cap holding device **70**, end post **60** of cap **50** rests on stop projection **76**. Engagement levers **100** engage recess **62** at first ends, pass over engagement fulcrums **102**, and are interconnected with actuating rods **104** at second ends. Springs **106** bias engagement levers to a horizontal position. Actuating rods **104** are interconnected with release buttons **108** on housing **72** of cap holding device **70**.

In order to release the cap **50** from the cap holding device **70**, one or more release buttons **108** are actuated in the direction as shown by arrow **F**, to move actuating rods **104** downward in the direction of arrow **G** to pivot engagement levers **100** about fulcrums **102** and against the bias of springs **106** to urge the cap **50** and the syringe **10** upward in the direction of arrow **H**, and out

of the cap holding device in the direction of arrow **I** while disengaging the engagement levers **100** from the recess **62** of post **60**.

In summary, the cap holding device of the present invention includes a cap **50** engagable with hub **42** which carries a needle **44** to cover both the cartridge end **46** and injection end **48** of the needle **44**. The cover includes internal protrusions **56** which engage one or more recesses **43** on hub **42**. The needle assembly **40** can then be attached to the syringe body **20**. The cap **50** extends beyond the cartridge end **46** of needle **44** to prevent inadvertent needle sticks during assembly of the syringe **10**. Thereafter, the syringe **10** with needle assembly **40** and cap **50** is inserted into the cap holding device **70**. In order to remove the needle from the cap, a foot pedal or other actuating device is utilized. Importantly, the foot pedal or actuating device is remote from needle **44** and allows one to remove the needle from the cap without the need to position ones hands in proximity to the needle, thereby minimizing inadvertent sticks. After use, the syringe can be inserted back into the cap that has been retained in the cap holding device. Again, one does not need to position ones hands proximate the needle during this process, thereby minimizing the risk of inadvertent needle sticks.

When one is finished using the syringe, the syringe and cap can be removed from the cap holding device by actuating another button or other actuating device. Because the cap covers the needle, inadvertent needle sticks are prevented. Thereafter, the needle assembly **40** can be disconnected from the syringe **10** and discarded. Because the cap covers the cartridge end and injection end of the needle during this process, inadvertent needle sticks are prevented.

It may be desirable for the configuration of the cap to be keyed to the receptacle in the cap holding device to provide for alignment of the cap in the cap holding device so that the hooks engage the handles. Additionally, it should be noted that the construction of the hooks, handles and the attachment of the cap to the hub could be varied as desired. For example, the cap could have opposing internally facing protrusions that engage a recess in a hub and rather than providing handles on the cap, the cap could be pinched to deform the shape of the cap sufficiently to allow the protrusions to disengage from the hub. Other manners of constructing the hub, cap and housing are considered to be within the scope of the invention. The housing may be weighted by use of a heavy or weighted material, such as a metal, such as lead or the like. The weighted material can be used in the construction of the housing or can be placed into the housing for anchoring and stabilizing the device.

FIG. 8 is a view showing an alternate embodiment of the cap holding device **70** of the present invention, wherein electronic control is provided. A pair of solenoids **206** are positioned perpendicular to the longitudinal axis of the syringe **10**, and include hooked engagement members **208** for engagement with the handles **58** of the cap **50**. The hooked engagement members **208** are interconnected with the solenoids **206**, and move laterally in the direction indicated by arrows **J**. When a user depresses the foot switch **202**, electrical current is sent from the power source **200** to solenoids **206** via connections **204**. The current causes an electromotive force to be generated by the solenoids **206**, which, in turn, pull the engagement hooks **208** toward the solenoids **206**. This causes the protrusions **56** of the cap **50** to move away from the syringe, allowing same to be removed from the cap **50** while the cap **50** is retained in the holding device **70**. The solenoids **206** could be of any type or manufacture that provides sufficient force

to pull the handles **58** and urge the protrusions **56** away from the syringe **10**. After the syringe has been removed from the cap, the foot switch **202** is opened, causing current to cease flowing to the solenoids **206** and engagement members **208** to return to their original positions. The power source **200** could be any alternating (AC) or direct current (DC) power source. Any other electronic means for operating the cap holding device **70**, such as a motor-driven mechanism, is considered within the scope of the present invention.

The embodiment shown in **FIG. 8** could also include a mechanism for engaging and disengaging the cap **50** with the holding device **70**, such as the mechanism discussed earlier with reference to **FIGS. 6-7**. It should be noted that this mechanism could also be modified to be operated electrically, wherein one or more solenoids are provided for engaging and disengaging the end post **60** of the cap **50**. Such an arrangement would work in conjunction with the electronic control mechanism of **FIG. 8** to provide an entirely electrically operated device.

Having thus described the invention in detail, it is to be understood that the foregoing description is not intended to limit the spirit and scope thereof. What is desired to be protected by Letters Patent is set forth in the appended claims.